A METHOD AND APPARATUS FOR A
NOTIFICATION SYSTEM OF AN AUTOMATION NETWORK

DESCRIPTION

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Technical Field

The present invention relates to a notification system. More specifically, the present invention relates to a notification system for an automation network.

10   ### Background of the Invention

The automation of both complex and simple tasks has improved the output quality of such tasks while also providing operator personnel with the ability to focus on other tasks requiring human intervention. However, some level of human intervention with the automation process is usually required. System bottlenecks 15   occur within the automation process when a response to a request for human intervention is delayed.

Notification applications have been incorporated into automation networks to alert operator personnel that human intervention is needed within the automation process. Some types of notification applications include bells, sirens, 20   speakers, whistles, flashing lights, process suspension or a combination thereof. Generally, these types of alarm applications require operator personnel to be nearby to respond to the alarm and maintain the automation system.

Other notification applications alert remotely located operator personnel to report to the automation network for intervention. These notification applications 25   are triggered by a device monitored on the network. Simple messages such as

e-mail are transmitted to notify operator personnel. More sophisticated notification systems initiate function blocks that are written in higher level languages, such a Java, to transmit e-mail for notifying operator personnel. However, the operative Java code is not transmitted to operator personnel. See

5 European patent EP0875023 and German patents DE29600609.2 and DE29622133.3.

Control systems have been integrated with the Internet to facilitate communication between a monitored device and operator personnel. Web access communication is limited because operator personnel or a web browser triggers the

10 communication as opposed to a controller or a monitored device. See U.S. Patent Nos. 5,805,442, 5,975,737 and 5,982,362.

Although operator personnel do not have to be near the automation network, the number of acceptable remote locations are limited due to the simplistic format of the notification message and/or the limitations and

15 requirements of the message receiver.

The present invention is provided to solve these and other problems.

Summary of the Invention

The present invention provides a notification system for an automated

20 network wherein an object is transmitted to communicate with operator personnel or any kind of third party software. The object can comprise both data and procedures to manipulate the data. The object is launched when a controller requests intervention by operator personnel.

An embodiment of the present invention is directed to a method of

25 providing notification to an operator of an automation network having an intelligent automation device and a network device located on the automation network. The method comprises the steps of sensing a signal from the network device. An object is transmitted to a receiving device operably connected to the network for notifying the operator, the object being responsive to the signal.

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Another embodiment of the present invention is directed to a notification system for an automation network. The notification system comprises an

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intelligent automation device having an object. Also included in the notification system is a sensor for monitoring a network device on the network. The sensor for monitoring the network device is operably connected to the intelligent automation device, wherein the intelligent automation device transmits the object in response

5   to the sensor. The object is transmitted to a receiving device having means for displaying the object.

Other features and advantages of the invention, which are believed to be novel and nonobvious, will be apparent from the following specification taken in conjunction with the accompanying drawings in which there is shown a preferred

10   embodiment of the invention. Reference is made to the claims for interpreting the full scope of the invention which is not necessarily represented by such embodiment.

Brief Description of the Drawings

15   FIGURE 1 is an illustration of a block diagram representing the present invention;

FIGURE 2 is an illustration of a block diagram representing an alternative embodiment of the present invention and,

FIGURE 3 is an illustration of a block diagram representing a portion of

20   the function block diagram.

Detailed Description of the Preferred Embodiment

While this invention is susceptible of embodiments in many different forms, there is shown in the drawings and will herein be described in detail

25   preferred embodiments of the invention with the understanding that the present disclosure is to be considered as an exemplification of the principles of the invention and is not intended to limit the broad aspect of the invention to the embodiments illustrated.

This invention is directed to transmitting an object from a function block

30   diagram 11, e.g., International Electrotechnical Commission (IEC) 1131 OFB, DFB, and EFB, etc.; to a receiving or display device 16, such as a monitor, for requesting human intervention with an automation network 10. Specifically, the

function block contains an object, preferably a Java-like module, that is transmitted to, and activated at, its destination receiving device 16. The receiving device 16 will launch the Java-like object to notify an operator of a situation affecting the automation network 10. Alternatively, the object can be transmitted to interact

5   with another network or software module.

This invention allows operator personnel to be notified of a network event requesting human intervention without requiring operator personnel to continuously maintain an active alarm handling application for the automation network 10. An object is transmitted by the program application, i.e., function

10 block diagram, of an intelligent automation device 12 to notify and request intervention by an operator. This is useful in alarm applications and when occasional intervention by an operator is required in an automation process. In addition, a programmer can create an object that is integrated within the intelligent automation devices's application program and thus, able to be easily modified at

15 the same time the controller's program is edited. Preferably, the invention is used with a programmable logic controller 12 (PLC), but any other intelligent automation device can be used, i.e., AC-inverter, motion controller, drives, circuit breakers, etc.

In Figure 1, a function block 14 resides within a controller's application

20 program and is energized or activated through a function block diagram 15. The function block 14 includes an object that is transmitted to a receiving device 16 for notifying operator personnel. The receiving device 16 has means for receiving and displaying the object, e.g., a computer having a web browser.

The object has a defined data type and data structure that includes both data

25 and functions. The object can be a file containing extensible markup language (XML), hyper text markup language (HTML), wireless application protocol (WAP) or WML (an XML application) that is specifically devised for small screens and navigation without a keyboard. WML is found on devices such as smart phones and communicators with simple mail transfer protocol (SMTP), or

30 Java code. Some object oriented programming languages are Java, C++ and Smalltalk.

FIGURE 3 is an illustration of a block diagram representing a portion of the function block diagram 15. An input from a network device (not shown) on the network is monitored, preferably through polling, by sensing a signal from the network device. In response to the signal from the network device, the function

5   block can transmit an object containing a Java-like code to the display device 16. An agent residing at the display device 16 can be activated to display the object to request intervention by an operator. In another embodiment of the invention, the object activates the agent on the display device 16.

Upon receipt of a Java, HTML, XML or WML based object, the receiving

10   device 16 stores the object in a temporary location of the receiving device 16. The receiving device 16 displays the object for notification to an operator. Preferably, a web browser displays an image on the screen of the receiving device 16. However, it is to be understood that audible notification or any other type of sensory notification to the receiving device 16 is also contemplated by this

15   invention. If the intervention request is transmitted by a network device 20 in Java, HTML, XML or WML, the receiving device 16 displays a graphic image related to the network device 20 that initiated the controller's request for intervention. The receiving device 16 then waits for the operator personnel to intervene. If desired, an operator can send a message response back to the function

20   block 14, EFB, through the receiving device 16. The function block diagram waits for a message response from the receiving device 16. The response can close the connection or abort it by setting a bit or flag within the function block 14. If the operator transmits a return message, the information is placed in a location specified by the function block diagram 14.

25   Other messages having different protocols can also be sent to various other receiving devices 16; such as XML to computers; WML to cell phones; wireless application protocol (WAP) to mobile phones, pagers, two-way radios, smartphones and communicators; hyper text markup language (HTML) to web browsers; simple mail transfer protocol (SMTP) to electronic mail boxes, etc. In

30   addition, a handheld device such as a personal digital assistant (PDA) that combines computing, telephone/fax, and networking features can also be used as a receiving device 16. A PDA can function as a cellular phone, fax, and personal

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organizer. Unlike portable computers, most PDAs are pen-based, using a stylus rather than a keyboard for input. PDAs can incorporate handwriting recognition features and some PDAs can also react to voice input by using voice recognition technologies. Thus, operator personal can provide a written or oral response to the controller 12 requesting intervention.

Figure 2 represents an alternate embodiment of the present invention wherein transmission of an object to the receiving device 16 is wireless. A receiving device 16 having an agent, preferably a computer with a browser, monitors network events on a predetermined port. A function block code 14 i.e., EBD, EFB, OFB, is energized through a function block diagram 11 and connects to the agent at a predetermined receiving device 16, e.g., computer, pager, cell phone, etc. The function block 14 sends the object to the agent or an other server, such as a SMTP server. The object can contain any markup language, e.g., XML, HTML, WML or Java code. If the object contains SMTP, the object is e-mailed without awaiting a reply from the receiving device 16. The agent initiates a web browser on the receiving device 16 if the message is Java, HTML, XML or WML.

The object executes at the receiving device 16, perhaps displaying a graphic image of a network device 20 that requires attention. The browser waits for operator personnel to intervene. If an operator enters a response message, the response message is sent back to the function block 14 wherein the controller 12 can act in accordance with the response message. The message response is placed in a location specified by the function block 14.

While specific embodiments have been illustrated and described, numerous modifications come to mind without significantly departing from the spirit of the invention and the scope of protection is only limited by the scope of the accompanying claims.